<u>RESPONSE TO OFFICE ACTION</u>

Favorable reconsideration of this application is requested in view of the foregoing amendments and the following remarks. Claims 1 - 13 and 20 - 27 are pending in the application. Claims 20 - 27 are newly presented. Nonelected claims 14 - 19 are canceled without prejudice or disclaimer.

The claims have been amended in order to more clearly define the invention, support for which is found in the figures and related parts of the specification. The Amendment does not introduce new matter.

At pages 2 - 3 of the Action, dated May 22, 2001, the Examiner discusses a restriction requirement. Applicant affirms the election of Group I, claims 1 - 13, with traverse. Claims 14 - 19 were withdrawn from consideration in the Action. The traversal is based on the fact that examination of all the claims would not place an undue burden on the Office. As noted above, claims 14 - 19 have been cancelled without prejudice or disclaimer.

At page 3 of the Action, the Examiner objects to the drawings. The specification is amended to recite detail numerals 46A, 46B, 46C, 46D as implicitly suggested by the Examiner. The beginning point and end point of the amplitude "a" in figure 3 are demarcated by the two horizontal lead lines in figure 3; these lead lines can be visually extended to the left in the drawing.

Accordingly, withdrawal of this objection is respectfully requested.

At page 4 of the Action, the Examiner objects to the title. The title is amended as suggested by the Examiner.

Accordingly, withdrawal of this objection is respectfully requested.

At page 4, of the Action, the Examiner objects to the absence of a close parenthesis. Page 9, line 13 is amended to recite ")" after "10D" as implicitly suggested by the Examiner.

Accordingly, withdrawal of this objection is respectfully requested.

Claims 10-12 are rejected under 35 USC 112(1) as not described in the specification. The limitations referred to by the Examiner are described between page 9, line 9 and page 11, line 34 of the specification as originally filed.

Accordingly, withdrawal of this rejection is respectfully requested.

Claims 1-4 and 13 are rejected under 35 USC 103(a) as obvious over Ow et al. (U.S. Pat. No. 5,349,365) in view of Trzakowski (U.S. Pat. No. 6,189,201). This rejection is untenable.

Ow et al disclose a helical quadrifilar antenna of the well-known configuration, i.e. having a plurality of substantially helical conductors acting as radiators which are arranged to form a 3-dimensional structure. As in other quadrifilar helical antennas, each radiator is a distributed component in the form of a transmission line.

In contrast to Ow et al., Trzaskowski et al disclose a planar printed circuit such as a transmitter or filter network with discrete lumped elements such as lumped inductors which form parts of resonant circuits. These inductors are planar single-turn coils connected by printed tracks to other lumped components, and the internal diameter of the coils is increased by grinding to adjust their respective inductances.

Ow et al's antenna includes no lumped components and, in particular, has no identifiable discrete lumped inductors, whether in the form of single turn coils or otherwise, which are susceptible to adjustment in the way proposed by Trzaskowski et al. Therefore, one of ordinary skill in the art would not find Trzaskowski's technique indicative of a way of modifying Ow's

quadrifilar antenna by removing conductive material from the distributed transmission line components which form radiators in a 3-dimensional structure.

Claims 1-4 and 13 are not disclosed or suggested by Ow et al. (U.S. Pat. No. 5,349,365) and/or Trzakowski (U.S. Pat. No. 6,189,201) because the teachings of these references are not compatible as discussed above. Further, claims 10-12 are not disclosed or suggested by Ow et al. (U.S. Pat. No. 5,349,365) and/or Trzakowski (U.S. Pat. No. 6,189,201) for the same reason. Therefore, all of claims 1-5 and 10-13 are allowable.

Accordingly, withdrawal of this rejection is respectfully requested.

In section 15, page 6 of the Action, the Examiner indicates that claims 5-9 would be allowable if rewritten to include all the limitations of the base claim and any intervening claims. This indication of allowable subject matter is very much appreciated. Claim 5 is rewritten as an independent claim as a mere matter of form and not for a reason related to patentability. Therefore claim 5 is allowable. Claims 6-9 depend from claim 5. Therefore, claims 6-9 are also allowable.

The Examiner is invited to contact the undersigned attorney at 512/536-3088 with any questions, comments or suggestions relating to the referenced patent application.

Respectfully submitted,

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Appendix
Marked-up versions of claims

1. A method of producing a quadrifilar antenna for circularly polarised radiation at frequencies above 200 MHz, the antenna comprising a plurality of substantially helical conductive radiating tracks located on an electrically insulative substrate, wherein the method comprises monitoring at least one electrical parameter of the antenna and removing conductive material from at least one of the tracks to bring the monitored parameter nearer to a predetermined value, thereby to increase the inductance of the track.

2. A method according to claim 1, wherein the conductive material is removed from the track by laser etching an aperture in the track, leaving the edges of the track intact on either side of the aperture.

3. A method according to claim 1 for producing an antenna in which the substrate is substantially cylindrical and the tracks include portions on a cylindrical surface of the substrate and a flat surface of the substrate, e.g., an end surface substantially perpendicular to the cylinder axis, wherein the conductive material is removed from a track portion or portions located on the flat surface.

4. A method according to claim 1 for producing an antenna having a plurality of helical track portions located in a substantially cylindrical substrate surface, and a plurality of respective connecting track portions located on a substantially flat end surface of the substrate to connect

the helical track portions to an axial feeder, wherein the material removal step comprises forming a cut-out in at least one of the connecting track portions.

5. (Amended) A method [according to claim 1] <u>of producing a quadrifilar antenna for circularly polarised radiation at frequencies above 200 MHz, the antenna comprising a plurality of substantially helical conductive radiating tracks located on an electrically insulative substrate, wherein the method comprises monitoring at least one electrical parameter of the antenna and removing conductive material from at least one of the tracks to bring the monitored parameter nearer to a predetermined value, thereby to increase the inductance of the track,</u>

wherein the monitoring step comprises coupling the antenna to a radio frequency source, bringing probes into juxtaposition with the tracks at predetermined locations, and measuring at least the relative phases of signals picked up by the probes associated with different respective tracks when the radio frequency is operated.

6. A method according to claim 5, wherein the probes are capacitively coupled to the respective tracks.

7. A method according to claim 5, wherein the probes are located in registry with track portions corresponding to the positions of voltage minima when the radio frequency source is tuned to the intended operating frequency of the antenna.

8. A method according to claim 5, wherein the probes are located in registry with end portions of the helical tracks.

9. A method according to claim 5 for producing an antenna in which each track has a first end portion adjacent a feed location and a second, opposite end portion spaced from the said feed location, wherein the material removal step comprises forming cut-outs in the first end portions and the monitoring step includes positioning the probes in juxtaposition with the second end portions.

10. A method according to claim 1, wherein material is removed from the tracks by forming a rectangular aperture in the or each affected track, the aperture having a predetermined width transverse to the direction of the track which is computed automatically in response to the result of the monitoring step.

11. A method according to claim 10, wherein with the width and length of the aperture are variable in response to the said monitoring result.

12. A method according to claim 1, wherein the monitoring step includes feeding the antenna with a swept frequency signal over a frequency range including the intended operating frequency of the antenna, monitoring the relative phases and amplitudes of signals in the radiating tracks, and removing conductive material from at least two of the tracks to bring the frequency at which substantial phase orthogonality occurs closer to the intended operating frequency.

13. A method according to claim 1, wherein the monitoring step includes feeding the antenna with a swept frequency signal over a frequency range including the intended operating frequency

of the antenna, monitoring the relative phases and amplitudes of signals in the radiating tracks to bring the difference between the monitored phases at a central resonant frequency nearer to 90°.

14. Canceled.

15. Canceled.

16. Canceled.

17. Canceled.

18. Canceled.

19. Canceled.

Please add new claims 20-27 as follows:

--20. A method of producing a quadrifilar antenna for circularly polarised radiation at frequencies above 200MHz, the antenna comprising a plurality of helical conductive radiating tracks located on an electrically insulative substrate, wherein the method comprises monitoring at least one electrical parameter of the antenna and removing conductive material from at least one of the tracks to bring the monitored parameter nearer to a predetermined value, thereby to increase the inductance of the track, and wherein the monitoring step comprises coupling the

antenna to a radio frequency source, bringing probes into juxtaposition with the tracks at predetermined locations, and measuring at least the relative amplitudes of radio frequency signals picked up by the probes associated with different respective tracks when the radio frequency source is operated.

21. A method according to claim 20, wherein the probes are capacitively coupled to the respective tracks.

22. A method according to claim 20, wherein the probes are located in registry with track portions corresponding to the positions of voltage minima when the radio frequency source is tuned to the intended operating frequency of the antenna.

23. A method according to claim 20, wherein the probes are located in registry with end portions of the helical tracks.

24. A method according to claim 20, wherein the material removal step comprises forming cut-outs in the first end portions and the monitoring step includes positioning the probes in juxtaposition with the second end portions.

25. A method of producing a quadrifilar antenna for circularly polarised radiation a frequencies above 200 MHz, the antenna comprising a plurality of helical conductive radiating tracks located on an electrically insulative substrate, wherein the method comprises monitoring at least one electrical parameter of the antenna and removing conductive material from at least

one of the tracks to form an aperture in the or each affected track to bring the monitored parameter nearer to a predetermined value, thereby to increase the inductance of the track.

26. A method according to claim 25, wherein the aperture is rectangular.

27. A method of producing a quadrifilar antenna for circularly polarised radiation at frequencies above 200 MHz, the antenna comprising a plurality of helical conductive radiating tracks located on an electrically insulative substrate, wherein the method comprises monitoring at least one electrical parameter of the antenna and removing conductive material from at least one of the tracks to bring the monitored parameter nearer to a predetermined value, thereby to increase the inductance of the track, and wherein the monitoring step includes feeding the antenna with a swept frequency signal over a frequency range including the intended operating frequency of the antenna, and monitoring the relative amplitudes of signals in the radiating tracks.--

Marked up text for the replacement of the paragraph bridging pages 5-6

Referring to Figure 1, 2A, 2B and 3, an antenna to which the present invention is applicable has an antenna element structure with four longitudinally extending antenna elements 10A, 10B, 10C, and 10D formed as narrow metallic conductor track portions on the cylindrical outer surface of a ceramic core 12. The core has an axial passage 14 housing a coaxial feeder with an outer screen 16 and an inner conductor 18. The inner conductor 18 and the screen 16 form a feeder structure for connecting a feed line to the antenna elements 10A - 10D. The antenna element structure also includes corresponding radial antenna elements 10AR, 10BR, 10CR, 10DR formed as metallic track portions on a distal end face [12D] of the core 12, connecting ends of the respective longitudinally extending elements 10A - 10D to the feeder structure. The other ends of the antenna elements 10A - 10D are connected to a common virtual ground conductor 20 in the form of a plated sleeve surrounding a proximal end portion of the core 12. This sleeve 20 is in turn connected to the screen 16 of the feeder structure 14 by plating on the proximal end face 12P of the core 12.

Marked-up text for the replacement of the paragraph at lines 17-33 of page 7

The conductive sleeve 20 covers a proximal portion of the antenna core 12, thereby surrounding the feeder structure 16, 18, with the material of the core 12 filling the whole of the space between the sleeve 20 and the metallic lining 16 of the axial passage 14. The sleeve 20 forms a cylinder connected to the lining 16 by the plating [22] of the proximal end face 12P of the core 12. The combination of the sleeve 20 and the plating 22 forms a balun so that signals in the transmission line formed by the feeder structure 16, 18 are converted between an unbalanced state at the proximal end of the antenna and an approximately balanced state at an axial position generally at the same distance from the proximal end as the upper linking edge 20U of the sleeve 20. To achieve this effect, the average sleeve length is such that, in the presence of an underlying core material of relatively high relative dielectric constant, the balun has an average electrical length in the region of $\lambda/4$ at the operating frequency of the antenna. Since the core material of the antenna has a foreshortening effect, and the annular space surrounding the inner conductor 18 is filled with an insulating dielectric material [17] having a relatively small dielectric constant, the feeder structure distally of the sleeve 20 has a short electrical length. Consequently, signals at the distal end of the feeder structure 16, 18 are at least approximately balanced.

Marked-up text for the replacement of the paragraph at lines 9-20 of page 9

A better understanding of the way in which the antenna operates and the affect of the apertures will be obtained by referring to the graph of Figure 4. Figure 4 was obtained by monitoring the radio frequency currents in the helical track portions 10A, 10B, 10C, and 10D adjacent the rim 20U of the sleeve 20 (i.e. the currents in the proximal end portions of the helical track position 10A - 10D) whilst the antenna was fed through its feeder structure 16, 18 with a swept frequency signal over a band encompassing the required operating frequency. There are four traces representing current phase and four representing current amplitude, each phase and amplitude trace being associated with one of the track portions10A - 10D. The phase traces are indicated by the reference numerals 30A, 30B, 30C, and 30D and the amplitude traces are indicated by the reference numerals 32A, 32B, 32C, and 32D. For completeness, a ninth trace 34 indicates the insertion loss looking into the feeder structure at the source end.

Marked-up text for the replacement of the paragraph at lines 23-33 of page 10

A test arrangement for performing the phase and amplitude measurements will now be described with reference to Figures 5 and 6. To monitor phase and amplitude in the region of the required operating frequency, the antenna 40 is moved into a testing location at the centre of a star-configuration probe array formed by probes 42A, 42[,]B, 42C, and 42D slidably mounted on radial tracks 44A, 44B, 44C, and 44D. In the test location, the antenna 40 is situated at a required height and rotational orientation (made possible by a notch (not shown) cut in one of the edges of the antenna end faces), so that the probes 42A to 42D are in registry with the proximal end [portion] portions 46A, 46B, 46C, 46D of the tracks 10A, 10AR, to 10D, 10DR, i.e. adjacent the rim 20U of the balun sleeve 20 (see Figure 1). The feed structure of the antenna 40 is proximally connected to the output 48 of a swept frequency r.f. source in a test unit.